Serial No. 09/934,791

PATENT
Docket No. 58027-012900

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## CLAIM AMENDMENTS

**Claim 1 (currently amended):** A method for reducing the temperature in a vertical-cavity surface-emitting laser (VCSEL), the method comprising:

forming at least one heat spreading layer between an active layer and at least one reflecting surface in a VCSEL; and

permitting for reduction of the VCSEL temperature by allowing heat to bypass the at least one reflecting surface and pass through the at least one thermally conductive InP heat spreading layer.

**Claim 2 (original):** The method according to claim 1, including doping the at least one of the heat spreading layers with an n-type material.

**Claim 3 (original):** The method according to claim 2, wherein the doping with the n-type material is effected by an InP compound.

**Claim 4 (original):** The method according to claim 1, further including forming a Distributed Bragg Reflector (DBR) as part of the at least one reflecting surface.

**Claim 5 (currently amended):** The method according to claim 1, further comprising the step of forming a tunnel junction between an apertured active ~~region~~ layer and the at least one of the reflecting surfaces.

**Claim 6 (currently amended):** The method according to claim 5, further including ~~having~~ an alloy of InAlGaAs, in the active ~~region~~ layer, substantially lattice matched to InP.

**Claim 7 (currently amended):** The method according to claim 5, further including ~~having~~ an alloy of InGaAsP, in the active ~~region~~ layer, substantially lattice matched to InP.

**Claim 8 (currently amended):** The method according to claim 5, further including an alloy of InGaAs, in the active ~~region~~ layer, substantially lattice matched to InP.

**Claim 9 (original):** The method according to claim 4, further including alternating layers of $Al_{a1}Ga_{1-a1}As_bSb_{1-b}$ and $Al_{a2}Ga_{1-a2}As_bSb_{1-b}$ in the DBR.

**Claim 10 (original):** The method according to claim 9, further including the step of assigning b greater than about 0.5, a1 greater than about 0.9, and a2 less than about 0.3.

**Claim 11 (currently amended):** The method according to claim 4, further including ~~having an~~ undoped DBR.

**Claim 12 (original):** The method according to claim 1, further effecting the VCSEL to exhibit continuous wave operation at temperatures greater than about 80 degrees Celsius.

**Claim 13 (original):** The method according to claim 5, further including an n-type InP and p-type InAlAs in the tunnel junction.

**Claim 14 (original):** The method according to claim 1, further providing a thickness of about 1-3λ to the at least one heat spreading layer.

**Claim 15 (currently amended):** The method according to claim 5, further providing a mixture to selectively etch the active ~~region~~ layer to form an aperture in the VCSEL and simultaneously preclude substantial etching of the at least one heat spreading layer.

**Claim 16 (currently amended):** A method for reducing the thermal impedance in a vertical-cavity surface-emitting laser (VCSEL), the method comprising:

forming a first thermally conductive InP heat spreading layer between a first reflecting surface and an active layer in a VCSEL;

forming a second thermally conductive InP heat spreading layer between a second reflecting surface and the active layer in a VCSEL: and

said first and second heat spreading layers reduce the thermal impedance in the VCSEL by allowing an injected current to bypass the reflecting surfaces.

**Claim 17 (original):** The method according to claim 16, wherein the forming steps include doping the heat spreading layers with an n-type material.

**Claim 18 (original):** The method according to claim 17, including effecting the doping with the n-type material with an InP compound.

**Claim 19 (original):** The method according to claim 16, further including forming a Distributed Bragg Reflectors (DBRs) as part of the first and the second reflecting surfaces.

**Claim 20 (currently amended):** The method according to claim 16, further comprising the step of forming a tunnel junction between an apertured active ~~region~~ layer and the first reflecting surface.

**Claim 21 (currently amended):** The method according to claim 20, further including ~~having~~ an alloy of InAlGaAs, in the active ~~region~~ layer, substantially lattice matched to InP.

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**Claim 22 (currently amended):** The method according to claim 20, further including ~~having~~ an alloy of InGaAsP, in the active ~~region~~ layer, substantially lattice matched to InP.

**Claim 23 (currently amended):** The method according to claim 20, further including an alloy of InGaAs, in the active ~~region~~ layer, substantially lattice matched to InP.

**Claim 24 (original):** The method according to claim 19, further including alternating layers of $Al_{a1}Ga_{1-a1}As_bSb_{1-b}$ and $Al_{a2}Ga_{1-a2}As_bSb_{1-b}$ in the DBR.

**Claim 25 (original):** The method according to claim 24, further including the step of assigning b greater than about 0.5, a1 greater than about 0.9, and a2 less than about 0.3.

**Claim 26 (currently amended):** The method according to claim 19, further including ~~having~~ undoped DBRs.

**Claim 27 (original):** The method according to claim 16, further effecting the VCSEL to exhibit continuous wave operation at temperatures greater than about 80 degrees Celsius.

**Claim 28 (original):** The method according to claim 20, further including an n-type InP and p-type InAlAs in the tunnel junction.

**Claim 29 (original):** The method according to claim 16, further providing a thickness of about 1-3λ to each of the heat spreading layers.

**Claim 30 (currently amended):** The method according to claim 20, further providing a mixture to selectively etch the active ~~region~~ layer to form an aperture in the VCSEL and simultaneously preclude substantial etching of each of the heat spreading layers.

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**Claim 31 (currently amended):** A vertical-cavity surface-emitting laser (VCSEL) operating at a reduced temperature, the VCSEL comprising:

a first and a second reflecting surfaces in a VCSEL;

an active layer in the VCSEL;

a first and a second thermally conductive InP heat spreading layers in the VCSEL, said first heat spreading layer being in between the first reflecting surface and the active layer, and the second heat spreading layer being in between the second reflecting surface and the active layer; and

the first and second heat spreading layers allowing heat generated in the VCSEL to bypass the first and second reflecting surfaces, thereby reducing the temperature of the VCSEL.

**Claim 32 (cancelled)**



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